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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/823,843	03/30/2001	Benjamin P. Olding	M-11562 US	6108

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EXAMINER	
JELINEK, BRIAN J	
ART UNIT	**PAPER NUMBER**
2615	

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/823,843	OLDING ET AL.	
	Examiner	Art Unit	
	Brian Jelinek	2615	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-10 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-10 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 3/30/2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 3/30/2001.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This is a first office action in response to application no. 09/823,843 filed on 3/30/2001 in which claims 1-10 are presented for examination.

Drawings

Figures 1-5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 5, 7, and 9-10 are objected to because of the following informalities: there is insufficient antecedent basis for the limitation in the claim.

Claim 5 recites the limitation "said transfer function " in lines 1-2 of the claim.

Claim 10 recites the limitation "said transfer function" in lines 1-2 of the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-2, and 6-7 are rejected under 35 U.S.C. 102(e) as being anticipated by Acharya (U.S. Pat. No. 6,392,699).

Regarding claim 1, Acharya teaches an image sensor (Fig. 5, Sensor 600), comprising: a sensor array comprising a two-dimensional array of pixel elements (Fig. 1a), the sensor array outputting digital signals as k-bit pixel data representing an image of a scene (Fig. 5, Pixels 10 bits); and a companding circuit for companding k-bit pixel data into h bits, h being less than k (Fig. 5, element 625). Furthermore, it is clear that Acharya provides a data memory for storing h-bit pixel data for each of the pixel elements because the data of the companding unit (Fig. 5, element 625) must be buffered or stored in some fashion in order to be operated on by a following processing unit (e.g., Fig. 5, element 627).

Regarding claim 2, Acharya teaches the companding circuit comprises a look-up table containing values for mapping a k-bit number to a h-bit number (Fig. 5, element 626; col. 10, line 65-col. 11, line 2).

Regarding claim 6, Acharya teaches a method for generating electrical signals representing an image in a digital (Fig. 5, Pixels 10 bits) image sensor (Fig. 5, Sensor 600), comprising: generating digital signals as k-bit pixel data (Fig. 5, Pixels 10 bits), the pixel data

being associated with each pixel element in a sensor array of pixel elements and corresponding to a level of an analog signal indicative of a light intensity impinging on the pixel element (Fig. 5, Sensor 600); companding k-bit pixel data into h bits for a first one of the pixel elements, h being less than k (Fig. 5, element 625). Furthermore, it is clear that Acharya proveds a data memory for storing h-bit pixel data in a location in a data memory associated with the first one of the pixel elements because the data of the companding unit (Fig. 5, element 625) must be buffered or stored in some fashion in order to be operated on by a following processing unit (e.g., Fig. 5, element 627).

Regarding claim 7, Acharya teaches companding comprises mapping a k-bit number to a h-bit number using a look-up table (Fig. 5, element 626; col. 10, line 65-col. 11, line 2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 6, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson (U.S. Pat. No. 6,563,535) in view of Reitmeier et al. (U.S. Pat. No. 6,560,285).

Regarding claim 1, Anderson teaches an image sensor (Fig. 1, element 104), comprising:

a sensor array comprising a two-dimensional array of pixel elements (col. 4, lines 15-19), the sensor array outputting digital signals as k-bit pixel data representing an image of a scene (Fig. 1, element 105) because the Analog Signal Processor performs analog to digital conversion on raw CCD data, thus outputting a k-bit digital signal. Furthermore, Anderson teaches the Capture Data Path (Fig. 2A, element 201) performs slight compression before loading an input buffer (col. 4, line 62-col. 5, line 2) via a bus (Fig. 2A, element 113), and that the bus speed becomes a limiting factor as large amounts of data are transferred between a processor and memory because the bus becomes overloaded (col. 2, lines 5-10). Further still, Anderson teaches a data memory, in communication with the sensor array, for storing compressed pixel data for each of the pixel elements (Fig. 2A, element 210). Anderson does not specifically teach that the slight compression is accomplished with a companding circuit.

However, Reitmeier et al. teaches encoding 10-bit image information as an 8-bit image signal with a compander in order to provide an image signal that is suitable to be transported according to lower dynamic range techniques (col. 1, line 54-col. 2, line 7). One of ordinary skill in the art would have provided the compander of Reitmeier et al. in order to map the high dynamic range image information from an image sensor to a lower dynamic range suitable for transportation (col. 1, line 54-col. 2, line 7) across a bus. As a result, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the compander of Reitmeier et al. for the purpose of performing the slight compression of Anderson in order to map the high dynamic range image information of Anderson's image sensor to a lower dynamic range image signal suitable for transportation across a bus, thereby minimizing the bus load mentioned in Anderson (col. 2, lines 5-10).

Regarding claim 3, Anderson teaches the Capture Data Path (Fig. 2A, element 201) performs slight compression before loading an input buffer (col. 4, line 62-col. 5, line 2) via a bus (Fig. 2A, element 113), and that the bus speed becomes a limiting factor as large amounts of data are transferred between a processor and memory because the bus becomes overloaded (col. 2, lines 5-10). Furthermore, Reitmeier et al. teaches encoding 10-bit image information as an 8-bit image signal in order to provide an image signal that is suitable to be transported according to lower dynamic range techniques (col. 1, line 54-col. 2, line 7). Further still, Reitmeier et al. teaches remapping high dynamic range information to a lower dynamic range appropriate to the transport process utilized (col. 2, lines 19-24). Although Reitmeier et al. does not specifically teach h=k-1, Official Notice is given that it would have been obvious to one of ordinary skill in the art at the time of the invention to compand image data to h bits, where h=k-1, in the case where this lower dynamic range is appropriate for a utilized transport process (col. 2, lines 18-23).

Regarding claim 6, Anderson teaches a method for generating electrical signals representing an image in a digital image sensor (Fig. 1, elements 104 and 105), comprising: generating digital signals as k-bit pixel data (Fig. 1, element 105) because the Analog Signal Processor performs analog to digital conversion on raw CCD data, thus outputting a k-bit digital signal, the pixel data being associated with each pixel element in a sensor array of pixel elements and corresponding to a level of an analog signal indicative of a light intensity impinging on the pixel element. Furthermore, Anderson teaches the Capture Data Path (Fig. 2A, element 201) performs slight compression before loading an input buffer (col. 4, line 62-col. 5, line 2) via a bus (Fig. 2A, element 113), and that the bus speed becomes a limiting factor as large amounts of

data are transferred between a processor and memory because the bus becomes overloaded (col. 2, lines 5-10). Further still, Anderson teaches storing h-bit pixel data in a location in a data memory associated with the first one of the pixel elements (Fig. 2A, element 210). Anderson does not specifically teach that the slight compression is accomplished with a companding circuit.

However, Reitmeier et al. teaches encoding 10-bit image information as an 8-bit image signal with a compander in order to provide an image signal that is suitable to be transported according to lower dynamic range techniques (col. 1, line 54-col. 2, line 7). One of ordinary skill in the art would have provided the compander of Reitmeier et al. in order to map the high dynamic range image information from an image sensor to a lower dynamic range suitable for transportation (col. 1, line 54-col. 2, line 7) across a bus. As a result, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the compander of Reitmeier et al. for the purpose of performing the slight compression of Anderson in order to map the high dynamic range image information of Anderson's image sensor to a lower dynamic range image signal suitable for transportation across a bus, thereby minimizing the bus load mentioned in Anderson (col. 2, lines 5-10).

Regarding claim 8, please see the 103 rejection of claim 3.

Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson (U.S. Pat. No. 6,563,535), in view of Reitmeier et al. (U.S. Pat. No. 6,560,285), and further in view of Meeker (U.S. Pat. No. 5,313,298).

Regarding claim 4, Reitmeier et al. teaches the companding circuit applies a transfer function for companding the k-bit pixel data into h bits (Fig. 4A; col. 10, lines 42-47). Furthermore, Reitmeier et al. teaches a piece-wise transfer function being a linear function at low intensity values (Fig. 4A, element 430A) and compressed transfer function at higher intensities (Fig. 4A, element 440A; (col. 10, lines 42-52). Although Reitmeier et al. teaches that linear and non-linear methods may be used together (col. 10, lines 29-30), Reitmeier et al. dose not specifically state that the non-linear method in a combined linear/non-linear transfer function may be a logarithm function.

However, Meeker teaches approximating human visual perception with a logarithmic curve (col. 4, lines 1-16) in order to minimize the degree to which a human will perceive noise introduced in a video signal by its transmission (col. 4, lines 35-38). One of ordinary skill in the art would have provided the logarithmic curve of Meeker for the compressed transfer function of Reitmeier et al. in order to minimize the degree to which a human will perceive noise induced in a video signal by its transmission (col. 4, lines 35-38). As a result, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the logarithmic curve of Meeker for the compressed transfer function of Reitmeier et al. in order to minimize the degree to which a human will perceive noise induced in a video signal by its transmission.

Regarding claim 9, Reitmeier et al. teaches an act of companding comprises applying a transfer function for companding k-bit pixel data into h bits (Fig. 4A; col. 10, lines 42-47). Furthermore, Reitmeier et al. teaches a piece-wise transfer function being a linear function at low intensity values (Fig. 4A, element 430A) and compressed transfer function at higher intensities (Fig. 4A, element 440A; (col. 10, lines 42-52). Although Reitmeier et al. teaches that linear and

non-linear methods may be used together (col. 10, lines 29-30), Reitmeier et al. does not specifically state that the non-linear method in a combined linear/non-linear transfer function may be a logarithm function.

However, Meeker teaches approximating human visual perception with a logarithmic curve (col. 4, lines 1-16) in order to minimize the degree to which a human will perceive noise introduced in a video signal by its transmission (col. 4, lines 35-38). One of ordinary skill in the art would have provided the logarithmic curve of Meeker for the compressed transfer function of Reitmeier et al. in order to minimize the degree to which a human will perceive noise induced in a video signal by its transmission (col. 4, lines 35-38). As a result, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the logarithmic curve of Meeker for the compressed transfer function of Reitmeier et al. in order to minimize the degree to which a human will perceive noise induced in a video signal by its transmission.

Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson (U.S. Pat. No. 6,563,535), in view of Reitmeier et al. (U.S. Pat. No. 6,560,285), and further in view of Rao (U.S. Pat. No. 6,606,415).

Regarding claim 5, Meeker teaches that due to human visual perception, the just noticeable difference in luminance between two signals is proportional to the amplitude of the luminance signal; in particular, noise in a dark portion of an image may be perceived, whereas noise of a greater amplitude may go undetected in a brighter portion of the image (col. 4, lines 1-18). Furthermore, Meeker teaches that cameras have exploited human visual perception by using "taking" characteristic, which is approximated by a logarithmic curve (col. 4, lines 1-18).

Meeker does not specifically teach a transfer function increments k-bit pixel data in step size less than a perceptible threshold of the human visual capability.

However, Rao teaches that it is possible to quantize darker shades more than lighter shades since the human eye is more sensitive to lighter shades (col. 6, lines 39-43). Furthermore, Rao teaches that companding preserves small amplitudes at the expense of larger amplitudes so that lower levels are less affected when the quantization step size is increased allowing for greater compression without contouring effects normally seen with large quantization steps (col. 6, lines 4-19). As a result, Rao teaches adjusting transfer function increments in step sizes less than a perceptible threshold of the human visual capability. One of ordinary skill in the art would have companded small amplitudes less than larger amplitudes, according to the teaching of Rao, in order to maximize compression without causing contouring artifacts caused when an increase in step size exceeds the threshold of human visual perception. As a result, it would have been obvious to one of ordinary skill in the art at the time of the invention to compand small amplitudes less than larger amplitudes, according to the teaching of Rao, in order to maximize compression without causing contouring artifacts caused when an increase in step size exceeds the threshold of human visual perception.

Regarding claim 10, please see the 103 rejection of claim 5.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian Jelinek whose telephone number is (703) 305-4724. The examiner can normally be reached on M-F 8:00 am - 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Christensen can be reached on (703) 308-9644. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Brian Jelinek
9/27/2004

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